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PROMISING FUNGICIDES FOR THE MANAGEMENT OF SHEATH BLIGHT OF RICE

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ABSTRACT

Sheath blight is a major disease of rice that can cause economic yield loss under favourable environmental conditions. For the management of sheath blight, application of fungicides is one of the effective strategies. Systematic evaluation of commercially available fungicides from time to time is essential for evolving recommendations on effective chemical fungicides. Six new fungicides were tested against sheath blight under in vitro and field conditions. The fungicides tested were kresoxym methyl 44.3 SC (0.5ml l^{-1}), pencycuron 250 SC (1.5ml l^{-1}), fluzilazole 40 EC (0.5ml l^{-1}), iprodine + carbendazim 50 WP (1.5g l^{-1}), tebuconazole + trifloxystrobin 75WG (0.4g l^{-1}) and tebuconazole 250 EC (2ml l^{-1}) in comparison with recommended fungicide hexaconazole 5 EC (2ml l^{-1}) as standard check and an untreated control. Under in vitro conditions all the fungicides tested were inhibitory to R. solani compared to control. Tebuconazole + trifloxystrobin 75 WG, tebuconazole 250 EC, iprodine + carbendazim 50 WP and fluzilazole 40 EC were statistically on par with each other and with standard check fungicide hexaconazole 5 EC in inhibiting R. solani with complete inhibition (100 %). This was followed by kresoxim methyl (67.79%) and pencycuron (54.39%). Field studies were conducted to evaluate these fungicides against sheath blight. The systemic fungicides tebuconazole + trifloxystrobin 75 WG (0.4 g l^{-1}), tebuconazole 250 EC (1.5ml l^{-1}), fluzilazole 40 EC (0.5ml l^{-1}), and contact fungicide pencycuron 250 SC (1.5ml l^{-1}) were equally effective as standard check fungicide hexaconazole 5 EC (2ml l^{-1}) in reducing sheath blight severity and improving yield. These fungicides can be effectively utilized for the management of sheath blight of rice.

KEYWORDS: Sheath Blight, Rice, Fungicides, Rhizoctonia Solani

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Original Article

INTRODUCTION

Sheath blight of rice caused by *Rhizoctonia solani* Kuhn is one of the major diseases of rice throughout the rice growing areas of the world. The yield loss due to the disease usually ranges from 10- 30 per cent and can go upto 50 per cent (Slaton *et al.*, 2003). In a study conducted in Punjab, India by Chahal *et al*. (2003) observed reduction of 32.30 per cent in grain filling in rice when the sheath blight affected area of top three leaves was 54.3 per cent. High plant density and high rate of application of nitrogenous fertilizers favour the disease development. With the wide coverage of high yielding semi dwarf varieties with high tillering ability, the disease has been aggrevated in recent years and became the most important disease in rice growing regions (Li *et al.*, 2009). The occurrence and severity of this disease has been increased in recent years in India (Prakasam *et al.*, 2012). In Kerala State of India, sheath blight is a major problem particularly in *kharif* season. High rainfall and humidity prevailing

in this region and the susceptibility of the predominant varieties in cultivation are factors contributing high disease incidence. The inherent level of resistance in rice to sheath blight is very low. For the management of sheath blight of rice, an integrated approach is most appropriate including host plant resistance, cultural management, biological control and chemical control. In situations of sudden outbreak of the disease, the most effective method of management is the use of chemical fungicides. The efficacy of various fungicides against sheath blight of rice has already been reported by various workers. In Kerala, management of sheath blight by propiconazole has been reported. (Santhakumari and Rahmathniza (2004). The efficacy of trifloxystrobin 25% + tebuconazole 50% against sheath blight from West Bengal was reported by Bag *et al*. (2009). Johnson *et al*. (2013) found hexaconazole as an effective fungicide against sheath blight of rice. Metaminastrobin 20 SC reduced sheath blight severity in field trials conducted at Andhra Pradesh (Jagadeeswar *et al*., 2014). Timely application of effective fungicides is essential for the management of the disease. Systematic evaluation of commercially available fungicides from time to time is needed for evolving recommendations on chemical fungicides, so that the farmers can choose the fungicides based on the efficacy as well as cost. In the present study, six new fungicides were evaluated against sheath blight of rice under *in vitro* and field conditions.

MATERIALS AND METHODS

In vitro Evaluation of Fungicides Against Rhizoctonia Solani

Six new fungicides were tested *in vitro* against sheath blight pathogen *Rhizoctonia solani* in comparison with a recommended fungicide (standard check) and control. The experiment was done by poison food technique following completely randomized design with four replications. The fungicides tested were kresoxym methyl 44.3 SC (1 ml l^{-1}), pencycuron 250 SC (1.5ml l^{-1}), fluzilazole 40 EC (0.5 ml l^{-1}), iprodine + carbendazim 50 WP (1.5 g l^{-1}), tebuconazole + trifloxystrobin 75WG (0.4 g l^{-1}) and tebuconazole 250 EC (2 ml l^{-1}) were evaluated against *Rhizoctonia solani* in comparison with recommended fungicide hexaconazole 5 EC (2 ml l^{-1}) as standard check and control. 9 mm sized fungal discs of *R. solani* grown on potato dextrose agar media was placed at the centre of the poisoned media with required concentrations of the fungicides in petri dishes. Observation on the diameter of mycelial growth of the fungus was measured on seventh day.

Bioefficacy of Fungicides Against Sheath Blight

Field experiments were conducted at the Regional Agricultural Research Station, Pattambi, Kerala, for five seasons during the years 2012 to 2014. The experiment was conducted in randomized block design with four replications using the susceptible rice variety Jyothi. The nursery was raised and 25 days old seedlings were transplanted to the main field at a spacing of 15 × 10 cm in 10 m^2 sized plots.

Treatments

T_1 : Kresoxym methyl (44.3 SC) - 1.0 ml l^{-1}

T_2 : Pencycuron (250 SC) - 1.5 ml l^{-1}

T_3 : Fluzilazole (40 EC) - 0.5 ml l^{-1}

T_4 : Iprodine + Carbendazim (50 WP) - 1.5 g l^{-1}

T_5 : Tebuconazole + Trifloxystrobin (75WG) - 0.4 g l^{-1}

T_6 : Tebuconazole (250 EC) - 2.0 ml l^{-1}

T_7 : Hexaconazole (5 EC) - 2.0 ml l^{-1}

T_8 : Untreated (Control)

Inoculum Production and Inoculation of the Pathogen

The pure culture of the pathogen *Rhizoctonia solani* was multiplied in sterilized paddy grains in conical flask. The culture discs were put in the sterilized paddy grains in conical flasks and incubated for one week. The inoculum multiplied in the grains was mixed well prior to inoculation in the field. The grains with *Rhizoctonia solani* inoculum was placed uniformly at the centre of the each hills in the field.

Spraying of Fungicides

The required concentrations of fungicides were sprayed after three days of symptom expression. Spraying was done using Knapsack sprayer with a spray volume of 500ml per 10 m^2. Two sprayings were given at 10 days interval.

Disease Recording

Severity of sheath blight was recorded before spraying and 10 days after the final spray. The observation on 10 plants per plot was recorded. The grain yield was recorded at the time of harvest. The analysis of variance was performed and means were separated by Fischer's LSD Test.

RESULTS AND DISCUSSIONS

Under *in vitro* evaluation of fungicides all the tested fungicides were inhibitory to *Rhizoctonia solani.* Fluzilazole 40EC, iprodine + carbendazim 50 WP, tebuconazole + trifloxystrobin 75 WG and tebuconazole 250 EC were statistically on par with the standard check fungicide, hexaconazole 5 EC in inhibiting *R. solani* with an inhibition of 100 %. Eventhough pencycuron 250 SC and kresoxym methyl 44.3 SC were not as inhibitory as hexaconazole 5 EC, these fungicides inhibited *R. solani* to the tune of 54.3 per cent and 67.79 per cent respectively (Table 1).

The results of field experiments revealed that there was significant difference among the treatments in reducing sheath blight severity. The pooled analysis of data for five seasons on sheath blight severity and yield are given in table 2. The disease severity ranged from 29.00 per cent to 67.73 per cent among the treatments. The disease severity was lowest in tebuconazole + trifloxystrobin 75 WG (29.00 %) which was statistically on par with the check fungicide, hexaconazole 5 EC (29.93%) and significantly superior to control (67.73%). Shahid *et al.,* (2014) also reported the field efficacy of tebuconazole + trifloxystrobin against sheath blight. The fungicides tebuconazole 250 EC (29.96%), fluzilazole 40 EC (31.83%) and pencycuron 250 SC (32.10%) were also statistically on par with tebuconazole + trifloxystrobin 75 WG and the check fungicide, hexaconazole 5 EC in their effect on reducing sheath blight severity. The efficacy of tebuconazole + trifloxystrobin 75 WG (0.04%), tebuconazole 250 EC (0.1%) and pencycuron 250 SC (0.1%) against sheath blight was proved by Hunjan *et al*., (2011) from Punjab, India. The efficacy of tebuconazole 250 EC (1.5ml l^{-1}) for the management of sheath blight from Andhra Pradesh was reported by Raju *et al*., (2008). The effect of tebuconazole + trifloxystrobin 75WG, tebuconazole 250 EC and fluzilazole 40 EC under *in vitro* evaluation was also on par and was comparable with check fungicide. The fungicide kresoxym methyl 44.3 SC and pencycuron 250 SC were not as effective as other fungicides under *in vitro* evaluation. In the field also kresoxim methyl 44.3 SC (41.01%) was not as effective as trifloxistrobin+ tebuconzole 75 WG, tebuconzale 250 EC and fluzilazole 40 EC. However, the disease severity was significantly less in kresoxim methyl applied plots, compared to control. Even though under *in vitro* pencycuron exhibited less inhibition than kresoxym

methyl, under field condition pencycuron 250 SC (32.10%) preformed better than kresoxym methyl (41.01%) and was statistically on par with trifloxistrobin+tebuconazole 75 WG, tebuconazole 250 EC and fluzilazole 40 EC in reducing sheath blight severity. The field efficacy of pencycuron 250 SC against sheath blight on a susceptible rice variety MTU 7029 was reported from West Bengal by Chaudhury and Sarkar (2006). But it was quite opposite in the case of iprodine + carbendazim. It showed same inhibitory effect as that of tebuconazole + trifloxystrobin *in vitro* but its bioefficacy in the field was significantly less than this fungicide as well as fluzilazole 40 EC and tebuconazole 250 E C. This kind of varying performance of fungicides has been reported earlier by Mathivanan and Prabhavathi (2007). They found that the fungicide metalaxiyl + mancozeb has been found effective in inhibiting the mycelial growth of *Alternaria helianthi* under *in vitro* conditions, but it failed to give satisfactory control of leaf blight of sunflower in the field. Eventhough the fungicide iprodine + carbendazim 50 WP showed inhibition to*Rhizoctonia solani* as the other fungicides *in vitro*, its bioefficacy was less than the other fungicides.

By the application of the test fungicides an improvement of 11.85 to 21.30 per cent in yield was obtained compared to control. Among the fungicides tested tebuconazole + trifloxystrobin 75WG, tebuconazole 250 E C, fluzilazole 40 EC and pencycuron 250 SC were found to be equally effective in reducing sheath blight severity and improving yield as that of check fungicide, hexaconazole 5 EC. The application of these fungicides reduced the sheath blight by 52.60 to 57.18 per cent (Fig 1.) and improved in yield by 18.35 – 21.35 per cent (Fig 2.). The other two fungicides, kresoxym methyl and iprodine + carbendazim were not as effective as the check fungicide and other test fungicides in reducing sheath blight severity.

CONCLUSIONS

It is concluded from the study that the systemic fungicides tebuconazole+ trifloxistrobin 75 WG (0.4g l^{-1}), tebuconazole 250 EC (1.5 ml l^{-1}), fluzilazole 40EC (0.5 ml l^{-1}) and contact fungicide, pencycuron 250 SC (1.5 ml l^{-1}) can be effectively used for the management of sheath blight of rice.

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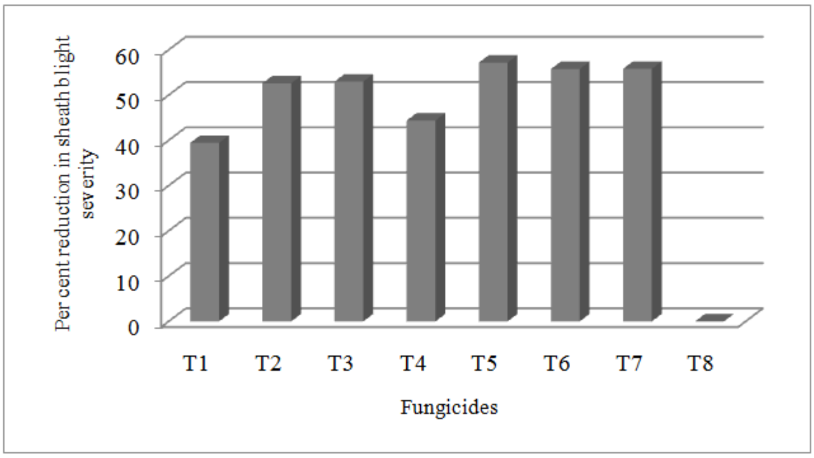

Figure 1: Effect of Different Fungicides on Sheath Blight Severity

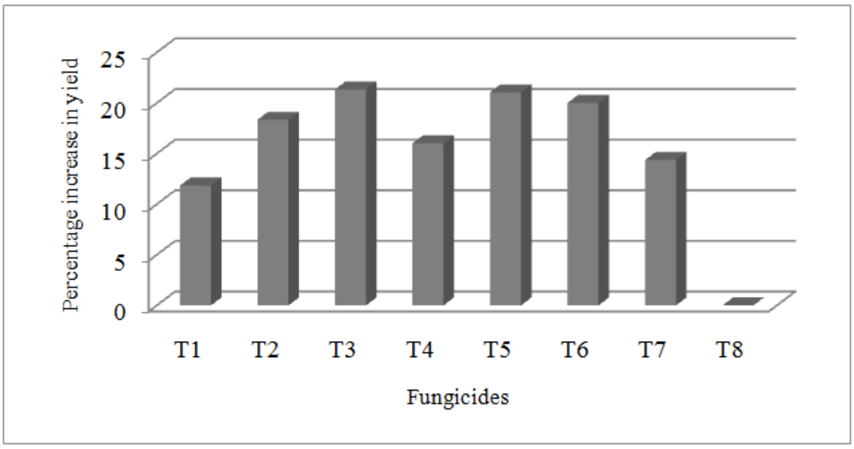

Figure 2: Effect of Different Fungicides on Yield

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APPENDIX

Table 1: Effects of Fungicides on Rhizoctonia Solani in Vitro

Treatments	Dose Per Litre	Diameter of the Fungal Growth (cm)	Per Cent Inhibition Over Control
T_{1-} Kresoxym methyl (44.3 SC)	1.0 ml	2.86 (1.96)	67.79
T_{2-} Pencycuron (250 SC)	1.5 ml	4.05 (2.25)	54.39
T_3 -Fluzilazole (40 EC)	0.5 ml	0.00 (1.00)	100.00
T_{4-} Iprodine + Carbendazim (50 WP)	1.5 g	0.00 (1.00)	100.00
T_{5-}Tebuconazole+Trifloxystrobin (75WP)	0.4 g	0.00 (1.00)	100.00
T_6 -Tebuconazole (250 EC)	2.0 ml	0.00 (1.00)	100.00
T_7 -Hexaconazole (5 EC)	2.0 ml	0.00 (1.00)	100.00
T_{8-} Untreated (Control)		8.88 (3.14)	0.0
LSD (0.05%)		0.08	

Values in parenthesis are √(x+1) transformed. Each value is a mean of four replications.

Table 2: Effect of Fungicides Against Sheath Blight of Rice

Treatments	Dose Per Litre	Sheath Blight Severity (%)	Yield (kg ha^{-1})
T_1 - Kresoxim methyl (44.3 SC)	1ml	41.01 (39.76)	3840
T_2 - Pencycuron (250SC)	1.5ml	32.10 (34.13)	4063
T_3 - Fluzilazole (40 EC)	0.5ml	31.83(33.46)	4166
T_4 - Iprodione + Carbendazim (50WP)	1.5g	37.66 (37.62)	3983
T5-Tebuconazole 50% +Trifloxystrobin 25% (75WG)	0.4g	29.00 (32.15)	4156
T_6 - Tebuconazole (Folicur 250 EC)	1.5ml	29.96 (32.81)	4120
T_7 - Hexaconazole (Contaf 5EC)	2ml	29.93 (32.84)	3926
T_8 - Control (Untreated check)		67.73(55.77)	3433
LSD (0.05%)		2.13	348

Values in parenthesis are arcsine transformed. Each value is pooled mean of five trials each with three replications.